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# Rose Pigments and Rose Breeding --- The Findings of C.H. Eugster and E. Marki-Fischer, and Their Application

M. S. Viraraghavan

In this article an attempt is made to summarize, from the layman's point of view, the conclusions that can be derived from a very important paper on the chemistry of rose pigments by C. H. Eugster and E. Märki-Fisher.

As could be expected, the main paper is highly technical, and requires a strong chemistry background, if one is to understand it. Also, as often happens, while the research conclusions are of great practical importance to rose breeders, the paper itself is directed to an entirely different class - organic chemists.

So an attemp: to bridge the gap, whatever its limitations, is very much in order. Readers may like to refer to my earlier article ‘New approaches to rosebreeding - the Arisumi papers' (Indian Rose Annual II, 1982) especially as the researches of the present authors are closcey connected with the earlier work of Dr. Arisumi.

Most of you are quite familiar with the basic information on rose pigments, which has been presented often enough in our annuals. In a nutshell, the colours of rose flowers are determined by two classes of pigments - the water soluble anthocyanins, and the closely related flavonols, which produce the red, pink and white shades, and the water insoluble carotenoids, which produce the bright yellow shades.

A very interesting feature of the paper is the conclusion, 'the great structural

diversity of the carotenoids (in roses) contrasts with the surprisingly small number of anthocyanins'. In fact the structure of 75 different types of carotenoids are elucidated.

In this background, what are the important conclusions which can be derived which are of interest to rosebreeders? The first set of these radically alters our perceptions of the natural occurence of rose pigments.

1. It is now part of rose folklore that the vermillion orange colour of roses is derived from the anthocyanin, pelargonidin, which first made its appearance, by mutation, in the polyantha, Gloria Mundi, and thereafter, in various roses of the type of Independence (1947), Super Star (1960) etc., culminating in modern vermillion roses too numerous to mention, But the authors establish that this is completely incorrect - very many old roses, e.g. the alba rose Konigin von Dänemark (1916), the hybrid perpetual, Général Jacqueminot (1853), the multiflora hybrid, Crimson Rambler (pre 1890) and the first yellow rose, Soleil d'Or (1900) contain significant quantities of pelargonidin. Even more surprising is the finding that many rose species - *Rosa rugosa*, *Rosa pendulina, Rosa willmottiae, Rosa pomifera* and Rosa gallica 'Versicolor' - which originate in quite different parts of the world, also contain this pigment.

2. One more part of rose folklore is that the carotenoid yellow colours arose only after the introduction of the Persian Yellow rose, *Rosa foctida* into the blood of modern roses, due to the well known work of the great French hybridist, Pernet Ducher, starting of course with Soleil d'Or. This again is modified by the authors who point out that many of the old yellow roses, such as the Tea and Noisette classes with a Chinese background, also contain carotenoid. The only difference is that the latter roses contain carotenoids from early stages in the biosynthesis whereas *Rosa foetida* derivatives contain more complex carotenoids, which, incidentally, have better colour stability.

These two major conclusions apart, certain very interesting possibilities for rose breeding emerge:

## 1. Better red roses

In addition to the anthocyanin, cyanidin, there is another closely related red pigment, chrysanthemin. If breeders could produce roses rich in chrysanthemin, we would have 'surprising red shades'. Rose varieties containing large quantities of chrysanthemin include the climbers François Juranville and Dorothy Perkins, and, of much more interest to Indian rose breeders, Souvenir de la Malmaison, which is widely grown in India. Some work with Souvenir de la Malmaison should be quite rewarding.

One other red pigment found in roses is paconin, and here the source accessible to Indian breeders is, surprisingly, *Rosa foetida* - perhaps not so surprising, as many rose breeders have noted that crosses with yellow roses result in better reds.

## 2. Better yellow and orange roses

There is an interesting conclusion that the bright orange roses e.g. Louis de Funès (Meilland, 1984) are derived from a mixture of the pigment, cyanidin mixed with carotenoid. This, in a way, contradicts, though not directly, the Arisumi conclusion that it is a mixture of pelargonidin and carotenoid which produces the orange shades.

As any rose grower is instinctively aware, the colour of yellow or orange roses is hardly as bright as in other garden flowers, e.g. nasturtium. This has been scientifically confirmed by the authors who show that the degree of colour saturation is much less in roses than in, for example, nasturtiums, with the nasturtium having a factor of 80 as contrasted with around 50 for the rose, as an index of colour saturation.

In roses, the degree of colour saturation in the parental species, *Rosa foetida* has not yet been reached and this is what breeders have to aim for.

Even more interesting is the possibility of producing quite new shades eg.

tomato red, if the pigment composition includes greater quantities of certain carotenoids found in large quantities in the old Noisette and Tea roses - William Allan Richardson and Alister Stella Gray, which used to be quite well known in India some time back. So here is another breeding opportunity.

Some fascinating sidelights are also provided, such as :

1. The famous Noisette climber, Maréchal Niel, shows different pigment composition if grown in a greenhouse, where the colour is primrose yellow, but much lighter when grown outside, owing to replacement of one pigment by another. What then happens in India where the outdoors is quite like a greenhouse in the West?

2. Many white roses, e.g. Virgo, Iceberg, etc., contain large quantities of carotenoids.

3. The bronze colour, which is so attractive from the rose breeding point of view, is due to an admixture of flavonols in high concentration, with carotenoids. This is proved experimentally for roses as far apart as the Noisette, William Allen Richardson (1878) and the Hybrid Tea, Whisky Mac (1967),

For those who are interested, a copy of the full paper can be obtained from the Editors.

**REFERENCE:**

1. The Chemistry of Rose Pigments - Prof. Dr. Conrad Hans Eugster, Dipl.-Chem. Edith Märki-Fischer, Angewandte Chemie, International Edition in English, Vol. 30, June 1991, pgs 654 - 672

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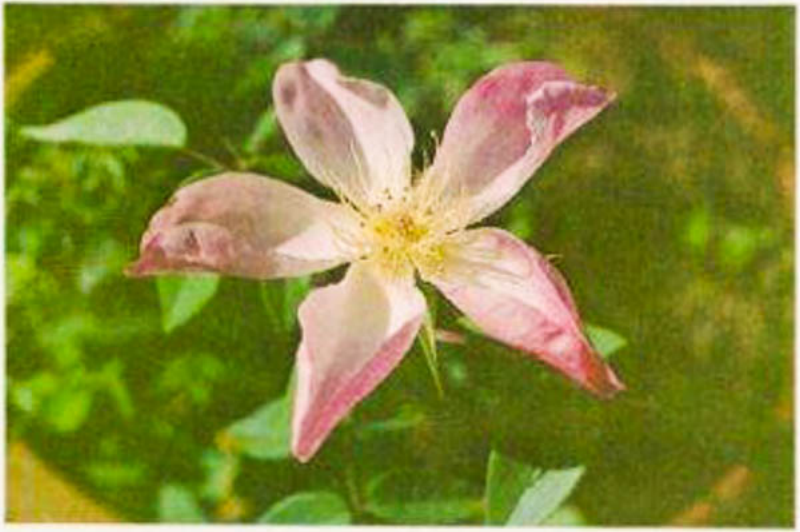
Progress in breeding with R. clinophylla



The first generation :
Mrs. B.R. Cant x R. clinophylla - M.S. Viraraghavan

The third generation :
Montezuma x [Little Darling x (R. clinophylla
x R. bracteata)] - M.S. Viraraghavan